
International Standard



1052

INTERNATIONAL ORGANIZATION FOR STANDARDIZATION • МЕЖДУНАРОДНАЯ ОРГАНИЗАЦИЯ ПО СТАНДАРТИЗАЦИИ • ORGANISATION INTERNATIONALE DE NORMALISATION

Steels for general engineering purposes

Aciers de construction mécanique d'usage général

First edition — 1982-11-01

Corrected and reprinted — 1983-06-01

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UDC 669.14.018.291

Ref. No. ISO 1052-1982 (E)

Descriptors : steels, structural steels, generalities.

Foreword

ISO (the International Organization for Standardization) is a worldwide federation of national standards institutes (ISO member bodies). The work of developing International Standards is carried out through ISO technical committees. Every member body interested in a subject for which a technical committee has been set up has the right to be represented on that committee. International organizations, governmental and non-governmental, in liaison with ISO, also take part in the work.

Draft International Standards adopted by the technical committees are circulated to the member bodies for approval before their acceptance as International Standards by the ISO Council.

International Standard ISO 1052 was developed by Technical Committee ISO/TC 17, *Steel*, and was circulated to the member bodies in March 1981.

It has been approved by the member bodies of the following countries:

Australia	Hungary	Poland
Austria	India	Romania
Brazil	Iran	South Africa, Rep. of
Bulgaria	Italy	Spain
Canada	Korea, Dem. P. Rep. of	Sweden
China	Korea, Rep. of	Tanzania
Czechoslovakia	Mexico	Turkey
Egypt, Arab Rep. of	Netherlands	United Kingdom
France	New Zealand	
Germany, F.R.	Norway	

The member bodies of the following countries expressed disapproval of the document on technical grounds:

Belgium
Ireland
USA

This International Standard cancels and replaces ISO Recommendation R 1052-1969, of which it constitutes a technical revision.

Steels for general engineering purposes

1 Scope and field of application

1.1 This International Standard specifies the qualities of general purpose steel set out in table 1 intended for engineering purposes.

1.2 This International Standard applies to hot-rolled steel sheet 3 mm or more thick, flats and bars generally used in the delivered state and as a rule in engineering structures.¹⁾

It does not deal with the following steels, which are dealt with in other International Standards :

- steels for boilers and pressure vessels (ISO 2604/4);
- sheet for forming and stamping (ISO 3573 and ISO 3574);
- structural steels for heat treatment;
- bars for concrete;
- general-purpose steels intended for metal constructions (ISO 630).

2 References

ISO 82, *Steel — Tensile testing*.

ISO 377, *Selection and preparation of samples and test pieces of wrought steels —*

*Part 1: Samples and test pieces for mechanical test.*²⁾

*Part 2: Samples and test pieces intended for the determination of the chemical composition.*²⁾

1) Examples of applications of these steels are:

Plates: machine frames

Rounds: mechanical structure, not heat treated

Flats: agricultural machines, not heat treated

These steels are not intended for welded constructions such as metal bridges and frames.

2) At present at the stage of draft. (Partial revision of ISO/R 377-1964.)

ISO 404, *Steel and steel products — General technical delivery requirements*.

ISO 630, *Structural steels*.

ISO 2566/1, *Steel — Conversion of elongation values — Part 1: Carbon and low alloy steels*.

ISO 2604/4, *Steel products for pressure purposes — Quality requirements — Part 4: Plates*.

ISO 3573, *Hot-rolled carbon steel sheet of commercial and drawing qualities*.

ISO 3574, *Cold-reduced carbon steel sheet of commercial and drawing qualities*.

3 Characteristics required

3.1 Method of manufacture

Unless otherwise agreed at the time of ordering, the method of manufacture is left to the manufacturer; however, the user shall have the right to be informed of the method on request at the time of delivery.

The steels shall be non-rimming.

3.2 As-delivered condition

The products are generally delivered in the as-rolled condition. Other as-delivered conditions may be agreed at the time of ordering.

3.3 Surface appearance — Defects

3.3.1 Surface appearance

The products shall have a smooth surface corresponding to the rolling method used; they shall have no surface defects that are prejudicial to their subsequent processing or intended use.

3.3.2 Elimination of defects

3.3.2.1 Minor defects may be removed by the manufacturer by grinding, provided that the thickness is not reduced locally by more than 7 % (with a maximum of 3 mm) in relation to its nominal value.

4 Characteristics of grades

4.1 Chemical composition

4.1.1 Ladle analysis

The maximum composition limits for analysis carried out on samples taken during casting are given in table 1.

4.1.2 Product analysis

The maximum composition limits of the product are given in table 1.

This analysis can be requested by the purchaser, in which case it shall be specified on the order.

Table 1 — Chemical composition from ladle and product analysis

Grade	P Ladle	P Product	S Ladle	S Product
	% max.			
Fe 490	0,050	0,055	0,050	0,055
Fe 590	0,050	0,055	0,050	0,055
Fe 690	0,050	0,055	0,050	0,055

4.2 Mechanical properties

The steels in the delivery condition as defined in 3.2 shall comply with the mechanical properties specified in table 2 when these are determined on test pieces selected in accordance with 5.4.

For products over 63 mm in thickness, the mechanical properties shall be the subject of an agreement between the manufacturer and the purchaser.

5 Acceptance testing

5.1 Rolled products

Rolled products covered by this International Standard may be the subject of acceptance tests in accordance with the conditions specified in ISO 404 relating to the mechanical properties and chemical analysis of the product. Verification of the chemical composition of the product is only carried out by agreement at the time of order.

5.2 Acceptance test unit

If acceptance testing has been specified on the order, the acceptance test unit is generally formed by cast; if agreed when ordering, it may be formed by batch¹⁾.

The acceptance test unit shall be

- 20 t or fraction thereof for acceptance by batch;
- 50 t or fraction thereof for acceptance by cast.

5.3 Types of tests

5.3.1 For each acceptance test or thickness range, as defined in table 2, the series of tests shall be carried out comprising

- one tensile test (or more, in accordance with 5.3.3);
- one product analysis, if agreed when ordering.

Table 2 — Mechanical properties

Grade	Yield strength, (min.) N/mm ² 1)			R_m N/mm ² 1)	A % min. 2) ($L_0 = 5,65 \sqrt{S_0}$)
	$e \leq 16$	$16 < e \leq 40$	$40 < e \leq 63$		
Fe 490	295	285	275	490 to 640	20
Fe 590	335	325	315	590 to 740	15
Fe 690	365	355	345	690 to 840	10

1) 1 N/mm² = 1 MPa

2) For transverse test pieces (plates and wide flats of width 600 mm and over), these values shall be reduced by two points, that is 18, 13 and 8 respectively.

1) A batch is defined as the output of one or more casts of the same grade, rolled into one class of product and submitted for acceptance at the same time.

5.3.2 If specified at the time of order, the purchaser or his representative may choose the products from which the test samples for the verification of properties are selected.

5.3.3 Unless the purchaser has agreed otherwise with the manufacturer the tensile testing procedure shall be as follows :

For each specified thickness range test samples shall be taken from the thickest product, except that for the range $e \leq 16$ mm the thickness of products shall be such that the maximum thickness is not greater than twice the minimum thickness.

5.4 Position and orientation of the test pieces (see ISO 377/1)

5.4.1 Plates and flats of a width equal to or greater than 600 mm

5.4.1.1 The test samples shall be taken midway between the centre line in the direction of rolling and the edge of the rolled product.

5.4.1.2 The axis of tensile test pieces shall be perpendicular to the direction of rolling.

5.4.2 Flats having a width less than 600 mm

5.4.2.1 The test sample shall be taken midway between the centreline in the direction of rolling and the edge of the rolled product.

5.4.2.2 The longitudinal axis of the test pieces shall be parallel to the direction of rolling. However, if agreed, the transverse test piece may be used for widths between 450 and 600 mm.

5.4.3 Rounds, squares, flats, hexagons and other similar products

The longitudinal axis of the test pieces shall be parallel to the direction of rolling.

For small sizes (diameter or side equal to or less than 25 mm), the test piece shall consist of a length of the product.

In other cases, the test samples shall be so taken that the axis of the test piece, so far as is possible, is located,

- for a prismatic test piece, on the outer 1/3 of the half-width or the half-diagonal (for squares and flats);
- for a cylindrical test piece, on the outer 1/3 of the half-diagonal or the half-diameter (see the figure in the annex) (in the case of rounds and hexagons).

5.5 Test methods — Types of test pieces

5.5.1 Tensile test (see ISO 82)

5.5.1.1 Normally the test piece used shall have a proportional prismatic or cylindrical shape and have an original gauge length given by the formula

$$L_0 = 5,65 \sqrt{S_0}$$

where S_0 is the cross-sectional area of the calibrated part of the test piece.

The prismatic test piece of rectangular cross-section shall have a maximum width on the gauge length portion of 40 mm, its thickness being that of the product; however, if the thickness of the product exceeds 30 mm, it may be reduced to 30 mm by planing or milling on one face only.

The cylindrical test piece shall have a diameter of between 10 and 30 mm, the original gauge length being determined by the above formula.

5.5.1.2 A non-proportional test piece with a fixed original gauge length may also be used. In this case,

a) if the gauge length is 200 mm (for products with a thickness ≤ 38 mm), the values for elongation are

$A > 18$ % for grade Fe 490;

$A > 13$ % for grade Fe 590;

$A > 8$ % for grade Fe 690;

b) if the gauge length is 50 mm (for products with a thickness > 38 mm), the values for elongation are

$A > 21$ % for grade Fe 490;

$A > 15$ % for grade Fe 590;

$A > 10$ % for grade Fe 690;

c) For other gauge lengths, reference shall be made to the conversion table (see ISO 2566/1).

In case of dispute, however, only the results obtained on a proportional test piece will be taken into consideration.

5.5.1.3 The yield strength specified in the tables is the upper yield stress or the proof stress (0,5 % total elongation).

If the 0,2 % proof stress (non-proportional elongation $R_{p0,2}$) the lower yield stress R_{eL} or proof stress (total elongation) R_{tx} is specified on the order, this specification is complied with in this respect if the value obtained by such measurement satisfies the specified yield strength values in table 2.

5.5.2 Defective tests and test pieces

5.5.2.1 When a test does not give the required results because of an error in execution, the test shall be cancelled.

Error in execution means defective machining, incorrect mounting in the test machine, malfunctioning of the machine or any other anomaly independent of the metal itself.

5.5.2.2 If a defective test piece gives satisfactory results, the batch shall be accepted, but the corresponding item (from which the test sample was taken) shall be submitted to an individual examination for soundness.

5.5.3 Supplementary tests

If, when testing, the required results are not achieved, additional tests unless otherwise agreed, shall be carried out as follows :

5.5.3.1 Tensile test

5.5.3.1.1 If the test piece does not give the required values, the corresponding item shall be deemed not to comply with the product specification unless two other test pieces from the same item are tested and give satisfactory results. In this case, the item and the batch shall be considered to comply with the specification.

5.5.3.1.2 If one or both additional test pieces do not satisfy the requirements, the corresponding item shall be deemed not to comply with the specification. In this case, the requirements of clause 6 may be applied.

5.5.4 Chemical analysis

5.5.4.1 In case of dispute, the method used for chemical analysis shall be in accordance with the requirements of the relevant International Standards. If no International Standards exist, the method to be used shall be agreed between the interested parties.

The samples may be taken from the test pieces used for verifying the mechanical properties or from drillings made from the full thicknesses of the product at the same place as the test pieces. In case of dispute, only the analysis of material taken

from the full thickness of the product shall be taken into consideration.

The requirements of ISO 377/2 are to be applied when selecting and preparing samples for chemical analysis.

5.6 Documents

The requirements of ISO 404 are to be applied. The type of certificate required shall be specified in the order.

6 Resubmission (see ISO 404)

6.1 The producer may resubmit for inspection products which have been rejected during earlier inspection and which have subsequently been processed (selection, heat treatment), details of which shall be indicated to the purchaser on request. In this case, tests shall be carried out as if they applied to a new batch.

6.2 The producer has the right to present rejected products for re-examination for another quality or grade.

7 Labelling

Unless an agreement to the contrary is made at the time of the order, the products shall be legibly marked to show

- the identification symbols for the grade of steel;
- the brand of the manufacturer;
- where necessary, symbols, letters or numbers which relate the test certificates, test pieces and products to each other.

In the case of products of small unit mass and which are consigned in tied bundles, the labelling may only be in the form of a tag securely attached to each bundle (or it may be marked on the upper plate).